evidence obtainable in the British Isles, in regard to the causes which, in this region, have determined the emergence and submergence of land. The vertical range of the changes of level to which the discussion in this address was limited amounts at least to as much as 700 feet, that is, some 600 feet below and 100 feet above the surface of the sea. But it will be remembered that, if we include all the deposits that contain recent marine shells *in situ*, the range of movement will be found considerably to exceed 1000 feet. The problem to be solved is whether this wide amplitude of shift in the relative levels of sea and land should be attributed to variations in the height of the surface of the oceanic envelope, or to secular movements of the terrestrial crust.

Any change of sea-level might be expected to be general and fairly uniform over long distances. The area of the British Isles is too restricted to permit us to believe that there could ever have been any serious difference in sea-level between the eastern and western coasts, or between the northern and southern limits of the country. Whether, therefore, the surface of the sea rose upon the land or sank away from it, we should find the records of these changes to extend over the entire region, and to be marked on the whole by a persistent uniformity of level. But an examination of the evidence fails to furnish proofs of any such extension and uniformity.

In the first place, the raised beaches, although so perfectly developed over nearly the whole of Scotland, disappear towards the north among the Orkney and Shetland Islands where, had they ever existed, they had every chance of being as well preserved as anywhere on the mainland. These islands obviously lay outside of the area affected by the movement that led to the formation of the beaches. But they could not have escaped from the effects of any rise in the level of the sea. Again, it is incredible that if the great 100-foot terrace, so prominent a feature in Scotland, had been formed by an uprise of the surface of the sea, the same terrace should not have been visible in thousands of favourable positions in England, Wales, and Ireland. Its entire absence cannot be accounted for by the presence of former ice-sheets in these regions, or by subsequent denudation. This absence may surely be taken as proof that the terrace never extended over these parts of our islands.

In the second place, had the position of the buried forests in the southern half of England and Wales been due to a rise in the sea-level, similar evidence of submerged land-surfaces at corresponding depths should have been met with generally round our coast-line. Neolithic man was an inhabitant of the country before this submergence was complete, and has dropped his handiwork in the beds of peat. In the north of Ireland and in central Scotland, however, during Neolithic time the land was emerging from the sea, and man has left his flint-flakes and weapons in the youngest raised beaches. Thus in the same period of geological time the sea-level must be supposed to have risen 50 or 60 feet in the south, and to have sunk 25 or 30 feet in the north. But we cannot suppose that within a distance of 300 or 400 miles there could have been a difference of 75 feet or more in the level of the water.

In the third place, there can be little doubt that when accurate levellings are taken of the raised beaches, it will be found that their apparent horizontality is not absolute, but that they rise slowly in certain directions, more particularly towards the axis of the country. It is not improbable also that a difference of level will be detected between the same beach on the eastern and on the western coast, and between its most northerly and most southerly parts. Such evidence of a deformation of the land can only be determined by careful geodetic measurements still to be undertaken.

In the meantime, on a review of the whole evidence, the author felt confident that the balance of proof is largely in favour of the old belief that the changes of level, of which our islands furnish such signal illustrations, have been primarily due, not to any oscillations of the surface of the ocean, but to movements of the terrestrial crust connected with the slow cooling and contraction of our globe. If this belief is to be overthrown, better evidence must be brought against it than has been hitherto adduced.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—On Saturday, May 28, the following honorary degrees were conferred on foreign delegates of the International Association of Academies:—D.C.L., Chevalier Edouard Descamps (of the University of Louvain), Ministre d'État, Sénateur Belge. D.Litt., J. L. Heiberg, University of Copenhagen; M. Émile Senart, Académie des Inscriptions et Belles-Lettres, Paris; M. Boutroux, Académie des Sciences Morales et Politiques, Paris; Prof. Collignon, Académie des Inscriptions et Belles-Lettres, Paris. D.Sc., Prof. Dr. Flechsig (Leipzig), Kgl. Sächsische Ges. der Wissenschaften; Prof. E. Ehlers, Kgl. Ges. der Wissenschaften, Göttingen; M. A. Giard, Académie des Sciences, Paris; Dr. Victor von Lang, Kaiserl. Akad. der Wissenschaften, Vienna; Prof. H. Mohn, chairman of the committee of the Videnskabs Selskab, Christiania; and Prof. H. Obersteiner, of the University of Vienna.

A meeting of the Junior Scientific Club was held on May 27. Papers were read by Mr. R. T. Lattey, on "Electrochemical Actinometers," and by Mr. E. C. Atkinson, on "Surveying in South Africa."

The following are among the honorary degrees to be conferred at the Encænia on June 22:—D.C.L., Mr. Charles Booth, F.R.S., president of the Royal Statistical Society. D.Sc., the Hon. C. A. Parsons, F.R.S.; Prof. Pierre Curie; Sir W. S. Church; Sir Andrew Noble, F.R.S.; Sir William Crookes, F.R.S.; Sir David Gill, F.R.S.; Sir John Murray, F.R.S.; Prof. Alfred Marshall; Prof. J. J. Thomson, F.R.S.; Prof. Horace Lamb, F.R.S.; Prof. A. R. Forsyth, F.R.S.; Prof. Dewar, F.R.S.; and Prof. Larmor, Sec.R.S.

CAMBRIDGE.—The following are the speeches delivered by the Public Orator, Dr. Sandys, on May 28, in presenting the under-mentioned members of foreign academies for the degree of Doctor in Science, *honoris causâ*:—

PROF. BAKHUYZEN, OF LEYDEN.

Inter doctores nostros novos primus hodie progreditur Scientiarum Academiae Amstelodamensis praeses, Batavorum astronomus insignis. Abhinc annos septemdecim consilii magni inter auctores fuit, quo caeli totius stellae, luminis ipsius auxilio chartis impressae, accuratissime redderentur. Etiam altero in opere immenso cum aliis consociatus est, quo caeli parte Boreali in regiones sedecim divisa, stellarum multitudo infinita minutissime observaretur. Iuvat hodie recordari caeli regionem astronomo Leidensi assignatam regioni Cantabrigiensi esse conterminam. Idem latitudinis (ut aiunt) varietatem, orbis terrarum axe leviter vacillante exortam, diligenter exploravit. Talium virorum ope Europae gentes scientiae amore excitatae, etiam in orbe terrarum accuratius dimetiendo invicem certant, astronomi illius antiqui laudem aemulatae,

"descripsit radio totum qui gentibus orbem."

PROF. FAMINTSYN, OF ST. PETERSBURG.

Russorum ab imperio adest botanicae professor eximius, qui studiorum provinciam nactus pulcherrimam, rerum omnium, quas terra gignit, physiologiam inter primos exploravit. Quam exquisitis usus experimentis, ostendit artificio quam admirabili herbarum genus omne solis radiis tactum virescat; etiam subter aquas algae minutissimae motu tremulo vibrent; foliorum denique omnium in cellis primordia quaedam viriditatis sese explicent, sed eadem solem nimium reformident. Quam feliciter idem novo lumine rem obscuram illustravit, vitamque illam communem, quae inter animalia quaedam minutissima et algarum cellulas intercedit, diei in lucem nuper protraxit.

"sic unumquicquid paulatim protrahit aetas
in medium, ratioque in luminis erigit oras."

EDMUND MOJSISOVICS, EDLER VON MOJSVÁR, OF VIENNA.

Vindobonensium ab Academia insigni ad nos advectus est vir de geologia praeclare meritus, qui duodequadraginta per annos palaeontologiae studiis deditus, Ammonis praesertim cornua, rupium in sinu insculpta, aevi prioris indicia (prope dixerim oracula) verissima existimavit. Quid dicam

de montium Dolomitorum serie et in Rhaetia et prope Venetos ab eodem dilucide descripta? quid de ratione illa quam inter Europae atque Asiae montes maximos intercedere indicavit? Oceanum certe ingentem, quem ex mari Mediterraneo ad oceanum Pacificum quondam extendere magister eius probavit, argumentis novis revera exstitisse discipulus confirmavit, ultraque Atlantida quandam, etiam maris "Arcto-Pacifici" fines antiquos determinavit. Nemo mortalium fortasse Oceanorum antiquorum amplitudines metiri audacius conatus est, nemo tot Alpium ingentium varietates accuratius inter sese comparare.

EMERITUS PROF. RETZIUS, OF STOCKHOLM.

Scandinavia, cuius etiam Regem inter doctores nostros numeramus, auspiciis optimis ad nos misit anthropologiae physicae conditoris insignis filium illustrem, qui anatomiam olim praeclare professus, eidem scientiae etiam otium suum et annos emeritos destinavit. Peritis nota sunt volumina illa maxima, eademque et typorum et imaginum splendore pulcherrima, et cerebri ipsius et sensuum omnium anatomiae et physiologiae explicandae dedicata. Idem, patriae non immemor, etiam Scandinaviae priscae "crania antiqua," arte eximia depicta, in libro singulari ordinavit. O terram felicem, quae non modo regia in domo artium et scientiarum tot cultores, tot patronos, numerat, sed etiam inter professores suos virum munificentia prope regia insignem non immerito admiratur.

PROF. RIECKE, OF GÖTTINGEN.

Academiae Goettingensis, et regiae domus Hanoverianae vinculo antiquo et hospitii iure vetere nobis coniunctae, socium eximium salutamus, qui scientiae physicae provincias multas peragravit; qui et de vi electrica cum crystallis consociata, et de corpusculis illis electricis inter nosmet ipsos primum indicatis, non minus breviter quam dilucide disputavit; qui denique, in scientiae illius experimentis libro in unico explicandis, inter tot res minutissimas ab alio aut alio observatas, rationem ipsam ubique eminere et apparere passus est. Illa vero rerum omnium domina est; illa nos praesertim et in scientiarum inventis praeteritis delectat et spe maioris in posterum incrementi excitat. Etenim de studiis ad lucis leges pertinentibus, non minus quam de ipsa luce, poëtae antiqui verba illa vera sunt:

"suppeditatur enim confestim lumine lumen
et quasi protelo stimulatur fulgere fulgur."

PROF. WALDEYER, OF BERLIN.

Academiam Berolinensem, et in scientiis et in litteris celeberrimam, oculis nostris quasi praesentem hodie reddit vir eximius, Academiae ipsius in scientiis physicis et mathematicis alter e ministris praecipuis, qui anatomiae in provinciis plurimis plurima cum laude versatus, vitae nascentis praesertim e studiis famam singularem est adeptus. Neque vitae ipsius circa limina obscura moratus, etiam urbium magnarum in lucem progressus est. Is certe, qui morum urbanitate et sermonis eloquentia anatomiae professores illos antiquos, Herophilos et Erasistratos, sine dubio superavit, est profecto, velut alter Hippocrates medicinae pater a Celso laudatus, "vir et arte et facundia insignis."

THE honorary degree of Doctor in Letters was conferred upon the Comte de Franqueville, sometime president of the Institute of France; Prof. Goldziher, member of the Hungarian Academy of Sciences and professor of Semitic philology in the University of Budapest; Prof. Gomperz, Emeritus professor of classical philology in the University of Vienna; Prof. Krumbacher, member of the Royal Bavarian Academy of Sciences and professor of mediæval and modern Greek philology in the University of Munich; M. Paul Leroy Beaulieu, of the Institute of France; and M. Georges Perrot, member of the Institute of France.

MR. W. GARDINER, F.R.S., Clare, Prof. C. S. Sherrington, F.R.S., Caius, and Mr. G. T. Walker, F.R.S., Trinity, have been approved for the degree of Doctor of Science.

The John Lucas Walker studentship in pathology, value 200*l.* a year for three years, will be vacant at Michaelmas. Applications are to be sent to Prof. Sims Woodhead before June 27. The student need not be a member of the university.

It is proposed to appoint a demonstrator of surgery, a demonstrator of experimental psychology, and an assistant curator of the museum of botany.

Sixty-seven men and twenty-two women have acquitted themselves so as to deserve honours in the mathematic tripos. The class list will be published on June 14.

A "NATURE STUDY" museum at St. George's Recreation Ground, Cable Street, E., will be opened to-morrow, June 3, at 5 p.m., by Sir William J. Collins, chairman of the Education Committee of the London County Council.

THE governing body of the Northampton Institute has decided to establish day classes in technical optics at the institute next winter. These courses will include full time courses, in which students will attend about thirty hours per week, and also morning classes for two mornings per week for those already engaged in the industry. An appeal is being made to members of the optical trade for donations towards the support of these technical classes with a view to the establishment and maintenance of British supremacy in the optical industry. It is reported that the London Education Committee will proceed shortly to consider the establishment of a central optical institute or college, and it is probable the decision arrived at will depend largely upon the attitude of the optical trade towards classes such as those at the Northampton Institute.

A REPORT prepared by the preliminary scientific education and examination committee of the General Medical Council was considered at the meeting of the council on Friday last, and the following resolutions were passed:—(1) That an examination in chemistry, in order to be sufficient, should comprise a written paper, a practical examination, and an oral examination; (2) that, in respect of chemistry, a synopsis or syllabus of subjects should be issued by each licensing body, and that the scope of the examination in chemistry should not fall below that which has been indicated in the report of the visitors, and has been generally approved by the licensing bodies; (3) that the examination in practical chemistry should not be limited to simple qualitative analysis, but should include easy preparations, simple volumetric analysis, and simple experiments illustrating important principles; (4) that an examination in physics, in order to be sufficient, should comprise a written paper and an oral examination, the latter to include practical questions on the use of physical instruments and apparatus; (5) that, in respect of physics, a synopsis or syllabus of subjects should be issued by each licensing body, and should include the elementary mechanics of solids and fluids and the rudiments of heat, light, and electricity; (6) that elementary biology should be retained in the curriculum; (7) that an examination in elementary biology, in order to be sufficient, should comprise a written paper and an oral examination, the latter to include practical questions on specimens and dissections, and on methods of microscopical investigation; and (8) that, in respect of elementary biology, a synopsis of subjects should be issued by each licensing body.

THE "Code of Regulations for Public Elementary Schools" for 1904 has been issued by the Board of Education. It has been much simplified, both in phraseology and arrangement. In the place of detailed schemes of work in a multitude of subjects suitable for the seven standards of an elementary school, the Board has sketched in broad outline a graduated course of instruction on which the education given in every public elementary school should be based. In this course of instruction a prominent place is given rightly to a "knowledge of the common phenomena of the external world, with special reference to the formation of a habit of intelligent and accurate observation, and to the application of that habit—in conjunction with simple forms of experiment—in the daily life and surroundings of the scholars." Nor is this the only opportunity taken by the Board, in this important official document, to show clearly its belief in the value and essential nature of scientific work in all schemes of education. An introduction to the code defines the purpose of an elementary school education as being "to form and strengthen the character and to develop the intelligence of the children." The introduction continues later to say that "with this purpose in

view it will be the aim of the school to train the children carefully in habits of observation and clear reasoning, so that they may gain an intelligent acquaintance with some of the facts and laws of nature." The importance of practical work and manual instruction is duly emphasised. This recognition of the claims of natural knowledge to an honoured place in the work of our primary schools will go far to reward men of science for their efforts to convince educational authorities of the value of scientific training. It is to be hoped that elementary school teachers will take full advantage of their new charter, and show by the improvement of their work that they value their new freedom to educate on rational lines.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 5.—"On certain Physical and Chemical Properties of Solutions of Chloroform in Water, Saline, Serum, and Hæmoglobin. A Contribution to the Chemistry of Anæsthesia.—(Preliminary Communication.)" By Benjamin **Moore**, M.A., D.Sc., Johnston Professor of Bio-chemistry, University of Liverpool, and Herbert E. **Roaf**, M.B., Toronto, Johnston Colonial Fellow, University of Liverpool.

Summary and Conclusions.

(1) It is believed that the experiments recorded in this paper justify the conclusion that chloroform forms an unstable chemical compound or physical aggregation with the proteids experimented with, and that it is carried in the blood in such a state of combination. Since proteids build up the protoplasm of living cells, it appears to us probable that chloroform, and other anæsthetics, must form similar combinations with protoplasm, and that anæsthesia is due to the formation of such compounds which limit the chemical activities of the protoplasm. The compounds are unstable, and remain formed only so long as the pressure of the anæsthetic in the solution is maintained. Such compounds are formed not only by hæmoglobin, but by serum proteid, and hence the position taken by the anæsthetic in hæmoglobin is not that of the respiratory oxygen. This is further shown by the fact that the oxygen-carrying power of hæmoglobin is not interfered with in presence of chloroform.

The effect of chloroform upon various forms of protoplasm will form the subject of future experiments.

The facts upon which we rely as proofs of the formation of a compound or aggregation between chloroform and serum proteid or hæmoglobin may be summarised as follows:—

(*a*) Chloroform has a much higher solubility in serum or hæmoglobin solutions than in saline or water.

(*b*) *Even in dilute solutions* at the same pressure the amount of chloroform dissolved in serum or hæmoglobin solution is considerably higher than in saline or water.

(*c*) The curve of pressures and concentrations in the case of water and saline is a straight line, while in the case of serum and hæmoglobin solution it is a curve, showing association at the higher pressures.

(*d*) In the case of serum, chloroform causes a marked opalescence, and also a slow precipitation at room temperature (15° C.), and at body temperature (40° C.) a rapid, though incomplete precipitation. In the case of hæmoglobin, 1·5 to 2 per cent. of chloroform causes a change of colour and commencing precipitation at room temperature, which becomes almost complete in the thermostat at 40° C., while 5 per cent. and over causes complete precipitation even at 0° C.

(2) The relations between chloroform pressure and concentration in solution have been worked out throughout a long range, from below the anæsthetising values (8 to 10 mm.) to nearly saturation in the case of water, saline, and serum.

Attention may be directed here to the important practical fact that with the same percentage of chloroform in the air breathed, serum or hæmoglobin, and therefore the blood will take up much more chloroform than would water or saline under equal conditions. Thus at the anæsthetising pressure, and at 40° C., the coefficient of distribution in the case of water and saline is approximately 4·6, while that of serum is 7·3; at room temperature (15° C.) these coefficients become 8·8 and 17·3 respectively.

"Note on the Lymphatic Glands in Sleeping Sickness." By Captain E. D. W. **Greig**, I.M.S., and Lieut. A. C. H. **Gray**, R.A.M.C.

The authors have examined the contents of lymphatic glands during life from fifteen sleeping sickness patients. In all of them actively motile trypanosomes were very readily found in cover-glass preparations taken from the cervical glands. They were also present in other glands, such as the femoral, but were not nearly so numerous.

The authors consider that their observations throw a new light upon the glandular enlargements which have been so constantly noticed in sleeping sickness, and that the disease is essentially a polyadenitis brought about by the arrest of the trypanosomes in the glands where many of them are destroyed, but whence some escape from time to time into the blood stream and thus occasion the increase which has been observed in the peripheral circulation.

They regard their observations upon the presence of trypanosomes in number in the lymphatic glands of both early cases of trypanosomiasis and advanced cases of sleeping sickness as affording important evidence of the unity of these diseases, and further proof that the trypanosomes are the essential cause of sleeping sickness.

"A Note on the Action of Radium on Micro-organisms." By Dr. Alan B. **Green**. Communicated by Sir Michael Foster, K.C.B., F.R.S.

The radium salt used in these experiments was 1 centigram of practically pure radium bromide, contained in a vulcanite and brass capsule fronted with thin talc. The emanations applied to micro-organisms were the β and γ rays.

(1) In the first set of experiments the germicidal action of these rays on various species of bacteria was investigated. A mass of bacteria was placed, as a thin layer, in a hollow-ground glass slide, and the capsule containing the radium was placed over the mass in such a way that the radium was brought within 1–2 mm. of it. All experiments and controls were made at room temperature.

It was found that the specific germ of vaccinia was killed by an exposure to radium of 22 hours or less. Non-spore-bearing bacteria were killed generally by 2 to 14 hours' exposure to radium, while spores were not killed by less than three days' exposure. It was further found that (*a*) as the distance between the radium and the bacteria was increased germicidal action became less evident and finally ceased; (*b*) as increased thicknesses of lead were interposed between the radium and the bacteria, *i.e.* as the β rays were cut off, germicidal action became less and less evident.

(2) It was ascertained that after exposure to radium at a distance of 1–2 mm. for 24 to 120 hours, micro-organisms themselves became radio-active. It has not yet been ascertained whether living micro-organisms can exhibit induced radio-activity, but micro-organisms killed by radium emanations show this activity. No radio-activity was found in bacteria not previously exposed to radium. The induced radio-activity of bacteria was shown by the ability of a mass, after exposure to radium, to photograph itself when brought into apposition with the film of a sensitised photographic plate. The best photographs so far have been obtained from cultures containing spores. Radio-active organisms have given off photo-actinic emanations after three months have elapsed since their exposure to radium. Photographs of such bacterial masses have been obtained through a double layer of lead foil, but as the β rays were cut off by interposing greater thicknesses of lead the passage of photo-actinic rays to the sensitised film was prevented.

"Further Note on some Additional Points in Connection with Chloroformed Calf Vaccine." By Dr. Alan B. **Green**. Communicated by Dr. W. H. Power, C.B., F.R.S.

Since a former paper on this subject was read in April, 1903, the use within two weeks of their collection from the calf of a large number of vaccine lymphs prepared by the chloroform process has resulted in high "case" and "insertion" success.

The following further points in connection with these vaccines have been investigated:—

(1) The temperature at which vaccine water emulsion is